Stainless steel valves for corrosive environments & water base fluids

ex-proof solenoid valves, Multicertification ATEX, IECEx, EAC or cULus certification

Ex-proof Stainless steel solenoids (1), with ATEX, IECEx, EAC Multicertification or cULus North American certification, for hazardous areas - see section B. B.

Two executions are available:
- **X** stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **XS** stainless steel for external and internal parts to withstand extreme and corrosive environmental conditions. Internal components are derived from standard valves.

Directional valves are available in two basic versions: poppet type, 3-way on-off valves.

DHAX(S) and DLAHX(S) valves are SIL compliance with IEC 61508 (TÜV certified) - see section 1.1

### 1 STAINLESS STEEL VALVES: MAIN DATA

<table>
<thead>
<tr>
<th>Valve execution (1)</th>
<th>Description</th>
<th>ISO size</th>
<th>DC (V)</th>
<th>AC (V)</th>
<th>ATEX, IECEx T class (2)</th>
<th>cULus T class (2)</th>
<th>Input Power</th>
<th>Max flow</th>
<th>Max pressure bar (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X (5)</td>
<td>XS</td>
<td>4 way, spool type direct solenoid valves</td>
<td>O6</td>
<td>ISO4401</td>
<td>T6, T4</td>
<td>T4, T3</td>
<td>8 W</td>
<td>25 W</td>
<td>T6, T5</td>
</tr>
<tr>
<td>DHA X4</td>
<td>DHA X4</td>
<td>3 way, poppet type, direct solenoid valves</td>
<td>O6</td>
<td>ISO4401</td>
<td>T6, T4</td>
<td>T4, T3</td>
<td>8 W</td>
<td>25 W</td>
<td>T6, T5</td>
</tr>
<tr>
<td>DLAHX6</td>
<td>DLAHX6</td>
<td>3 way, poppet type, direct solenoid valves</td>
<td>O6</td>
<td>ISO4401</td>
<td>T6, T4</td>
<td>T4, T3</td>
<td>8 W</td>
<td>25 W</td>
<td>T6, T5</td>
</tr>
<tr>
<td>DLAHMX4</td>
<td>DLAHMX(S)6</td>
<td>3 way, poppet type, direct solenoid valves</td>
<td>O6</td>
<td>ISO4401</td>
<td>T6, T4</td>
<td>T4, T3</td>
<td>8 W</td>
<td>25 W</td>
<td>T6, T5</td>
</tr>
<tr>
<td>DLAHPX6</td>
<td>DLAHPX6</td>
<td>3 way, poppet type, pneumatic operated valve</td>
<td>O6</td>
<td>ISO4401</td>
<td>T6, T4</td>
<td>T3</td>
<td>8 W</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>DLPX6</td>
<td>DLPX6</td>
<td>3 way, poppet type, pneumatic operated valve</td>
<td>no</td>
<td>–</td>
<td>T6, T4</td>
<td>T3</td>
<td>8 W</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>DHLPX</td>
<td>DHLPX</td>
<td>3 way, poppet type, hydraulic operated valve</td>
<td>no</td>
<td>–</td>
<td>T6, T4</td>
<td>T3</td>
<td>8 W</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>DLPX</td>
<td>DLPX</td>
<td>3 way, poppet type, hydraulic operated valve</td>
<td>no</td>
<td>–</td>
<td>T6, T4</td>
<td>T3</td>
<td>8 W</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>CART-MX-3</td>
<td>CART-MX-3</td>
<td>relief valve</td>
<td>no</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>CART-MX-6</td>
<td>CART-MX-6</td>
<td>direct screw-in</td>
<td>no</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>CART AREX-20</td>
<td>CART AREX-20</td>
<td>direct modular</td>
<td>no</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>HMPX-*</td>
<td>HMPX-*</td>
<td>relief valve</td>
<td>O6</td>
<td>ISO4401</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>SC LIX-2531*</td>
<td>LIMMX-2*</td>
<td>relief valve</td>
<td>25</td>
<td>ISO7368</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Notes:
(1) XS6 and XS4 versions differ only for the coil power (see Input Power)
(2) Solenoid temperature class see section B
(3) Max pressure on T port = 110 bar
(4) Optional electrohydraulic venting available on request.
(5) The “X” valves in full stainless steel execution are factory tested by Atos with mineral oil or pure water in order to avoid the contamination of the end user system. At the end of each valve model code must be specified the type of fluid to be used in the valve’s testing: “H” for hydraulic oil or “W” for pure water.

Ambient temperature:
Valves are provided by HNBR seals, which allow min ambient temperature down to -40 °C (max oil viscosity = 380 cSt).
Max ambient temperature for valves with PE option (FKM seals) is -20 °C.
For PED certified pressure relief cartridges see section 9.2

1.1 SIL compliance with IEC 61508: 2010
DHAX(S), DLAHX(S) meets the requirements of:
- **SC3** (systematic capability)
- max SIL 2 (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max SIL 3 (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)
### MATERIALS SPECIFICATION

<table>
<thead>
<tr>
<th>Valve type</th>
<th>solenoid housing</th>
<th>valve body</th>
<th>internal parts for X execution</th>
<th>internal parts for XS execution</th>
<th>spring</th>
<th>seals</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHAX(S)</td>
<td>AISI 630</td>
<td>AISI 316L</td>
<td>AISI 316L, 420B, 440C, 430F</td>
<td>Carbon steel</td>
<td>AISI 302</td>
<td>HNBR (buna), FKM (viton)</td>
</tr>
<tr>
<td>DLAHX(S)</td>
<td>AISI 630</td>
<td>AISI 316L</td>
<td>AISI 316L, 420B, 440C, 430F</td>
<td>Carbon steel</td>
<td>AISI 302</td>
<td>HNBR (buna), FKM (viton)</td>
</tr>
<tr>
<td>DLAMX(S)</td>
<td>AISI 630</td>
<td>AISI 316L</td>
<td>AISI 316L, 420B, 440C, 430F</td>
<td>Carbon steel</td>
<td>AISI 302</td>
<td>HNBR (buna), FKM (viton)</td>
</tr>
<tr>
<td>DLAPX(S)</td>
<td>AISI 630</td>
<td>AISI 316L</td>
<td>AISI 316L, 420B, 440C, 430F</td>
<td>Carbon steel</td>
<td>AISI 302</td>
<td>HNBR (buna), FKM (viton)</td>
</tr>
<tr>
<td>DLPMX(S)</td>
<td>AISI 630</td>
<td>AISI 316L</td>
<td>AISI 316L, 420B, 440C, 430F</td>
<td>Carbon steel</td>
<td>AISI 302</td>
<td>HNBR (buna), FKM (viton)</td>
</tr>
<tr>
<td>HMPX(S)</td>
<td>AISI 630</td>
<td>AISI 316L</td>
<td>AISI 316L, 420B, 440C, 430F</td>
<td>Carbon steel</td>
<td>AISI 302</td>
<td>HNBR (buna), FKM (viton)</td>
</tr>
<tr>
<td>LIMMX(S)</td>
<td>AISI 630</td>
<td>AISI 316L</td>
<td>AISI 316L, 420B, 440C, 430F</td>
<td>Carbon steel</td>
<td>AISI 302</td>
<td>HNBR (buna), FKM (viton)</td>
</tr>
<tr>
<td>SC LIX</td>
<td>AISI 316L</td>
<td>AISI 420B</td>
<td>-</td>
<td>-</td>
<td>AISI 302</td>
<td>HNBR (buna), FKM (viton)</td>
</tr>
</tbody>
</table>

### EX-PROOF SOLENOIDS: MAIN DATA

<table>
<thead>
<tr>
<th>Solenoid code</th>
<th>Multicertification</th>
<th>Voltage code</th>
<th>cULus</th>
<th>Power consumption</th>
<th>Coil insulation</th>
<th>Protection degree</th>
<th>Mechanical construction</th>
<th>Cable entrance and electrical wiring</th>
<th>Method of protection</th>
<th>Multicertification</th>
<th>Temperature class</th>
<th>Ambient temperature</th>
<th>cULus</th>
<th>Temperature class</th>
<th>Ambient temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHAXX6</td>
<td>OAX/WP, OAXS/WP</td>
<td>120V/60Hz</td>
<td>8W</td>
<td>12W</td>
<td>IP 65/67</td>
<td>100%</td>
<td>Flame proof housing classified Ex d, according to EN 60079-0: 2006, EN 60079-1: 2007</td>
<td>Internal terminal board for cable connection</td>
<td>Flame proof housing classified according to UL 1203 and UL492, CSA 22.2 n°30-1986 and CSA 22.2 n°139-13</td>
<td>T6 (≤ 85°C)</td>
<td>-40 ÷ +45 °C</td>
<td>-40 ÷ +105 °C</td>
<td>T4 (≤ 135°C)</td>
<td>-40 ÷ +45 °C</td>
<td>-40 ÷ +70 °C</td>
</tr>
<tr>
<td>DLAHPS6</td>
<td>OAHXXX/WP, OAHXXXS/WP</td>
<td>120V/60Hz</td>
<td>12W</td>
<td>12W</td>
<td>IP 65/67</td>
<td>100%</td>
<td>Flame proof housing classified Ex d, according to EN 60079-0: 2006, EN 60079-1: 2007</td>
<td>Internal terminal board for cable connection</td>
<td>Flame proof housing classified according to UL 1203 and UL492, CSA 22.2 n°30-1986 and CSA 22.2 n°139-13</td>
<td>T6 (≤ 85°C)</td>
<td>-40 ÷ +45 °C</td>
<td>-40 ÷ +105 °C</td>
<td>T4 (≤ 135°C)</td>
<td>-40 ÷ +45 °C</td>
<td>-40 ÷ +70 °C</td>
</tr>
<tr>
<td>DLAMPS6</td>
<td>OAKWX/WP, OAKWXS/WP</td>
<td>120V/60Hz</td>
<td>25W</td>
<td>33W</td>
<td>IP 65/67</td>
<td>100%</td>
<td>Flame proof housing classified Ex d, according to EN 60079-0: 2006, EN 60079-1: 2007</td>
<td>Internal terminal board for cable connection</td>
<td>Flame proof housing classified according to UL 1203 and UL492, CSA 22.2 n°30-1986 and CSA 22.2 n°139-13</td>
<td>T6 (≤ 85°C)</td>
<td>-40 ÷ +45 °C</td>
<td>-40 ÷ +105 °C</td>
<td>T4 (≤ 135°C)</td>
<td>-40 ÷ +45 °C</td>
<td>-40 ÷ +70 °C</td>
</tr>
</tbody>
</table>

**Notes:**
1. 48DC and 125DC only for Multicertification
2. For alternating current supply a rectifier bridge is integrated in the solenoid

### MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS
- for other fluids not included in below table, consult our technical office

<table>
<thead>
<tr>
<th>Assembly position / location</th>
<th>Any position for all valves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subplate surface finishing</td>
<td>Roughness index Ra 0.4 - flatness ratio 0.01/100 (ISO 1101)</td>
</tr>
<tr>
<td>Seals, recommended fluid temperature</td>
<td>HNBR seals (standard) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C</td>
</tr>
<tr>
<td>Recommended viscosity</td>
<td>15± 100 mm/s - max allowed range 2.8 ÷ 500 mm/s</td>
</tr>
<tr>
<td>Fluid contamination class</td>
<td>ISO 4406 class 21/19/NAS 1638 class 10, in line filters of 25 μm (β11₀ &gt;75 recommended)</td>
</tr>
<tr>
<td>Hydraulic fluid</td>
<td>Suitable seals type</td>
</tr>
<tr>
<td></td>
<td>Classification</td>
</tr>
<tr>
<td>Mineral oils</td>
<td>HNBR, FKM</td>
</tr>
<tr>
<td>Flame resistant without water</td>
<td>FKM</td>
</tr>
<tr>
<td>Flame resistant with water</td>
<td>HNBR</td>
</tr>
</tbody>
</table>

### cULus CERTIFICATION

<table>
<thead>
<tr>
<th>cULus marking</th>
<th>Class I</th>
<th>Division 1</th>
<th>Groups C&amp;D</th>
<th>Groups IIA&amp;IB</th>
<th>T6/T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>= Equipment for flammable gas and vapours</td>
<td>= Possibility of explosive atmosphere during normal functioning</td>
<td>= Atmosphere containing flammable gas</td>
<td>= Gas group</td>
<td>= Temperature class of solenoid surface referred to +55°C / +70°C ambient temperature</td>
<td></td>
</tr>
</tbody>
</table>

---

**EXAMPLE OF NAMEPLATE MARKING**

![Example of Nameplate Marking](image-url)

**Marking according to UL Directive**

Notified body and certificate number
In the following are resumed the valves marking according to multicertifications for Group II and Group I (mining).

### GROUP II, ATEX marking

**II 2 G** = Solenoid for surface plants with gas and vapors environment, category 2, suitable for zone 1 and zone 2

**Ex d** = Explosion-proof equipment

**T6/T4** = Solenoid temperature class (maximum surface temperature)

**Gb** = Equipment protection level, high level protection for explosive Gas atmospheres

**CE** = Mark of conformity to the applicable European directives

**II 2 D** = Solenoid for surface plants with dust environment, category 2, suitable for zone 21 and zone 22

**Ex d** = Explosion-proof equipment

**III C** = Suitable for conductive dust (applicable also IIIB and/or IIIA)

**IP66/67** = Protection degree

### GROUP II, IECEx marking

**Ex d** = Explosion-proof equipment

**II C** = Equipment of group IIC suitable for substances (gas) of group IIC

**T6/C/T135°C** = Maximum surface temperature (Dust)

**Db** = Equipment protection level, high level protection for explosive Dust atmospheres

### 6.1 EAC marking

EAC (EuRAsian certification) acknowledges the whole ATEX Directive 2014/34/EU. This certification is available only for gas environment (not for dust).

**II 2 G** = Solenoid for surface plants with gas and vapors environment, category 2, suitable for zone 1 and zone 2

**Ex d** = Explosion-proof equipment

**II C** = Equipment of group IIC suitable for substances (gas) of group IIC

**T6/T4** = Solenoid temperature class (maximum surface temperature)

**Gb** = Equipment protection level, high level protection for explosive Gas atmospheres

**EAC** = Mark of conformity to the IECEx Directive

**IP66/67** = Protection degree

### 7. SPOOL TYPE DIRECTIONAL SOLENOID VALVES: MODEL CODE

**DHA**

- **X** = Stainless steel execution for all parts
- **XS** = Stainless steel execution for external parts

Temperature class, see section 6

**4** = T4

**6** = T6 (only for XS execution)

Certification type

- **A** = omit for Multicertification
- **JUL** = cULus certification

**Sizes**

0 = 06

Valve configuration, see section 7.1

61, 63, 71, 75

(Constructions 63 and 75 are available only with spool type 1/2)

**Spool type**, see section 7.1

### 7.1 Hydraulic configuration

#### Configurations

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>-061*</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>-061*</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>-063*</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>-063*</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**A** = Solenoid threated connection for cable gland

**B** = 1/2" NPT ANSI/ASME B1.20.1 (tapered) for UL

**O** = Horizontal cable entrance
### Poppet Type Leak Free Directional Solenoid Valves: Model Code

<table>
<thead>
<tr>
<th>Model Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLAH</td>
<td>Direct (10 l/min)</td>
</tr>
<tr>
<td>DLAM</td>
<td>Direct (25 l/min)</td>
</tr>
<tr>
<td>DLHP</td>
<td>Hydraulic operated</td>
</tr>
<tr>
<td>DLAP</td>
<td>Solenoid piloted</td>
</tr>
<tr>
<td>DLP</td>
<td>Hydraulic operated</td>
</tr>
<tr>
<td>DLAP</td>
<td>Solenoid piloted</td>
</tr>
</tbody>
</table>

#### Options:
- **R**: Solenoid manual reset (not combinable with /V)
- **V**: Handwheel manual override (not combinable with /R)
- **O**: Horizontal cable entrance (only for DLAP)
- **D**: Internal drain
- **E**: External pilot pressure

#### Temperature Class (not for DLHP and DLP)
- **4**: T4
- **6**: T6

#### Certification Type
- **-**: Omit for Multicertification
- **/UL**: cULus certification

#### Test Fluid
- **H**: Mineral oil
- **W**: Pure water

#### Seals Material
- **PE**: FKM

#### Series Number

#### Voltage Code
- **24DC**: 24 V DC

#### Solenoid Threaded Connection for Cable Gland
- **M**: M20x1.5 UNI-4535 (6H/6g) for Multicertification
- **NPT**: 1/2” NPT ANSI/ASME B146.1 (tapered) for /UL

#### Diagrams

#### 8.1 Hydraulic Configuration
9 PRESSURE CONTROL VALVES: MODEL CODE

9.1 Screw-in type, STANDARD versions

<table>
<thead>
<tr>
<th>CART</th>
<th>MX-3</th>
<th>350</th>
<th>**</th>
<th>**</th>
<th>Test fluid, only for X execution:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H = mineral oil</td>
</tr>
<tr>
<td>MX(S)-3</td>
<td>G1/2</td>
<td></td>
<td></td>
<td></td>
<td>W = pure water</td>
</tr>
<tr>
<td>MX(S)-6</td>
<td>M33x1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AREX(S)-20</td>
<td>M35x1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pressure range:
see max pressure setting in section 9.3

(1): X = Stainless steel execution for all parts
XS = Stainless steel execution for external parts

9.2 Screw-in type, PED CERTIFIED versions

<table>
<thead>
<tr>
<th>CART</th>
<th>MX-3</th>
<th>420</th>
<th>PED</th>
<th>**</th>
<th>**</th>
<th>Test fluid, only for X execution:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H = mineral oil</td>
</tr>
<tr>
<td>MX(S)-3</td>
<td>G1/2</td>
<td></td>
<td>PED</td>
<td></td>
<td></td>
<td>W = pure water</td>
</tr>
<tr>
<td>MX(S)-6</td>
<td>M33x1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AREX(S)-20</td>
<td>M35x1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Max pressure setting
see max pressure setting in section 9.3

(1) X = Stainless steel execution for all parts
XS = Stainless steel execution for external parts

(2) For PED certified cartridges the min ambient / fluid temperature is:
-40°C for CART MX(S)-3 and CART MX(S)-6
-20°C for CART AREX(S)-20
-20°C for all cartridges with /PE option (FKM seals)

9.3 Hydraulic characteristics

<table>
<thead>
<tr>
<th>Valve model</th>
<th>CART MX(S)-3</th>
<th>CART MX(S)-6</th>
<th>CART AREX(S)-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max pressure setting [bar]</td>
<td>50</td>
<td>100</td>
<td>210</td>
</tr>
<tr>
<td>PED</td>
<td>420</td>
<td>420</td>
<td>420</td>
</tr>
<tr>
<td>Pressure range [bar]</td>
<td>4÷50</td>
<td>6÷100</td>
<td>7÷210</td>
</tr>
<tr>
<td>Max pressure on port T [bar]</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Max flow [l/min]</td>
<td>2.5</td>
<td>40</td>
<td>120</td>
</tr>
<tr>
<td>PED</td>
<td>2.5</td>
<td>60</td>
<td>150</td>
</tr>
</tbody>
</table>

(1) The values correspond to the min and max regulation of the valve’s craking pressure
(2) Ped valves should be operated without counterpressure on T line
9.2 Modular type

<table>
<thead>
<tr>
<th>HMP</th>
<th>X</th>
<th>011</th>
<th>/</th>
<th>350</th>
<th>**</th>
<th>*</th>
<th>*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modular pressure relief valve ISO 4401 size 06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X = Stainless steel execution for all parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XS = Stainless steel execution for external parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Configuration, see section 9.5

| 011 | 013 | 014 |

| Pressure range for HMP: | 50 = 6 ÷ 50 bar | 100 = 100 bar | 210 = 210 bar |

9.3 Control cover

<table>
<thead>
<tr>
<th>LIMM</th>
<th>X</th>
<th>2</th>
<th>/</th>
<th>350</th>
<th>**</th>
<th>*</th>
<th>*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover according to ISO 7368</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X = Stainless steel execution for all parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XS = Stainless steel execution for external parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Size: 2 = 25

| Pressure range | 50 = 6 ÷ 50 bar | 100 = 8 ÷ 100 bar | 210 = 10 ÷ 210 bar |
| 350 = 15 ÷ 350 bar |

9.4 Standard cartridge valve to be coupled with LIMMX(S) cover

<table>
<thead>
<tr>
<th>SC LI</th>
<th>X</th>
<th>25</th>
<th>31</th>
<th>/</th>
<th>2</th>
<th>**</th>
<th>*</th>
<th>*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartridge according to ISO 7368</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X = Stainless steel execution for all parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Size 25

Area ratio 1:1

| Spring cracking pressure | 1 = 0,3 bar | 2 = 1,2 bar | 3 = 3 bar |
| 6 = 6 bar |

Note: for LIMMXS cover, the standard SCLI-25* cartridge can be used

9.5 Hydraulic configuration

<table>
<thead>
<tr>
<th>CART-*X(S)</th>
<th>HMPX(S)-011/*</th>
<th>HMPX(S)-013/*</th>
<th>HMPX(S)-014/*</th>
<th>LIMMX(S)-2/*</th>
</tr>
</thead>
</table>

Test fluid, only for X execution:

<table>
<thead>
<tr>
<th>Test fluid</th>
<th>H = mineral oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>W = pure water</td>
<td></td>
</tr>
</tbody>
</table>

Seals material, see section 4:

| - = HNBR |
| PE = FKM |

Note: for LIMMXS cover, the standard SCLI-25* cartridge can be used.
CABLE GLANDS AND WIRING

10.1 Cable glands - only for Multicertification
Cable glands with threaded connections M20x1.5 for standard or armoured cables have to be ordered separately, see tech. table K600

10.2 Ex proof solenoid wiring

Multicertification

Standard version

1. cover with threaded connection for vertical cable gland fitting
2. cover with threaded connection for horizontal cable gland fitting
3. terminal board for cables wiring
4. screw terminal for additional equipotential grounding
5. standard manual override

PCB 3 poles terminal board suitable for wires cross sections up to 2.5 mm² (max AWG14)

Power supply: section of coil connection wires = 2.5 mm²
Grounding: section of internal ground wire = 2.5 mm²
section of external ground wire = 4 mm²

Cable Specification:
Power supply and transducer cables have to comply with following characteristics
- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor
- Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2.5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C (/BT” Models require a temperature range from -40°C to +110°C)
- For Class I wiring the 3C 1.5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

Cable temperature
The cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of the products.

For Multicertification

<table>
<thead>
<tr>
<th>Max ambient temperature [°C]</th>
<th>Temperature class</th>
<th>Surface temperature [°C]</th>
<th>Cable temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 °C</td>
<td>T6</td>
<td>&lt;85 °C</td>
<td>not prescribed</td>
</tr>
<tr>
<td>70 °C</td>
<td>T4</td>
<td>&lt;135 °C</td>
<td>90 °C</td>
</tr>
</tbody>
</table>

For cULus

<table>
<thead>
<tr>
<th>Max ambient temperature [°C]</th>
<th>Temperature class</th>
<th>Surface temperature [°C]</th>
<th>Cable temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 °C</td>
<td>T6</td>
<td>&lt;85 °C</td>
<td>100 °C</td>
</tr>
<tr>
<td>70 °C</td>
<td>T5</td>
<td>&lt;100 °C</td>
<td>100 °C</td>
</tr>
</tbody>
</table>
11 Q/p DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

12 OPERATING LIMITS OF ON/OFF DIRECTIONAL CONTROLS (based on mineral oil ISO VG 46 at 50°C)

The diagram have been obtained with warm solenoids and power supply at lowest value (V_{nom}-10%). For DHAX(S) valves the curves refer to application with symmetrical flow through the valve (i.e. P → A and B → T). In case of asymmetric flow the operating limits must be reduced.

12.1 Internal leakages for DLAHX(S), DLAHMX(S), DLAHPX(S), DLHPX(S), DLAPX(S) and DLPX(S): less than 5 drops/min (0.36 cm³/min) at max pressure.

12.2 Piloting pressure for DLAHPX(S) and DLHPX(S) max piloting pressure = 315 bar; min piloting pressure = 90 bar

for DLAPX(S) and DLPX(S) max piloting pressure = 315 bar; min piloting pressure = see above diagram
13.1 Standard versions

Note:
1) The valves can operate only in the white area of the above diagrams.
   The maximum flow values within the white area are those for which the pressure increases of +10% respect to the factory pressure setting.
   Pressure / flow values located in gray areas cannot be performed.

2) The working range in above diagrams is valid with 0 bar in T line.
   As general rule PED valves should be operated without counter pressure in the T line.
   Differently, in case of counter pressure in T line, the maximum flow is reduced respect to values reported in the diagrams.
   There is a relation between the maximum counter pressure, the factory pressure setting and the maximum flow: with a flow near to zero, the maximum counter pressure in T line is 10% of the factory pressure setting.
   With increasing flow, the maximum counter pressure in T line must be reduced. Contact Atos technical office for details.

13.2 PED certified versions

Note:
1) The valves can operate only in the white area of the above diagrams.
   The maximum flow values within the white area are those for which the pressure increases of +10% respect to the factory pressure setting.
   Pressure / flow values located in gray areas cannot be performed.

2) The working range in above diagrams is valid with 0 bar in T line.
   As general rule PED valves should be operated without counter pressure in the T line.
   Differently, in case of counter pressure in T line, the maximum flow is reduced respect to values reported in the diagrams.
   There is a relation between the maximum counter pressure, the factory pressure setting and the maximum flow: with a flow near to zero, the maximum counter pressure in T line is 10% of the factory pressure setting.
   With increasing flow, the maximum counter pressure in T line must be reduced. Contact Atos technical office for details.

14 REGULATED PRESSURE for modular valves
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x50-A4-70
Tightening torque = 5.5 Nm
Seals: 4 OR 108
Ports P, A, B, T: $\varnothing = 7.5$ mm (max).

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

Mass: 2.9 kg

Mass: 3 kg

Mass: 4.6 kg

Mass: 4.8 kg

horizontal cable entrance option /O

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x50-A4-70
Tightening torque = 5.5 Nm
Seals: 4 OR 108
Ports P, A, B, T: $\varnothing = 7.5$ mm (max).

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
**18 INSTALLATION DIMENSIONS OF DLAPX(S) AND DLPX(S) [mm]**

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x75-A4-70
Tightening torque = 5,5 Nm
Seals: 3 OR 3081; 2 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).

**19 INSTALLATION DIMENSIONS OF DLPX(S) AND DLPX(S) [mm]**

Mounting surface DLAPX(S)6 and DLPX(S) not ISO standard
Fastening bolts:
4 socket head screws M10x70-A4-70
Tightening torque = 40 Nm
Seals: 3 OR 3081; 2 OR 108
Ports X,Y: Ø = 7 mm (max)
Ports X, Y: Ø = 7 mm (max).

---

**DLAPX(S)-6-3A/M**
**DLAPX(S)-6-3C/M** (dotted line)

**DLPX(S)-6-3A/M**
**DLPX(S)-6-3C/M** (dotted line)

**DLPX(S)-3A**
**DLPX(S)-3C**

**DLPX(S)-3A**
**DLPX(S)-3C**

---

**Mass: 5 kg**

---

**ISO 4401: 2005**
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x75-A4-70
Tightening torque = 5,5 Nm
Seals: 3 OR 3081; 2 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).

---

**Mass: 5 kg**

---

**ISO 4401: 2005**
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x75-A4-70
Tightening torque = 5,5 Nm
Seals: 3 OR 3081; 2 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).

---

**Mass: 5 kg**
19 INSTALLATION DIMENSIONS OF SCREW IN PRESSURE RELIEF VALVES [mm]

CART MX(S)-3"

CART MX(S)-6"

dotted line only for option /PED

Note: for cavity dimensions see table C010 section 1

20 INSTALLATION DIMENSIONS OF MODULAR AND CARTRIDGE VALVES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: M5x**-A4-70
Tightening torque = 5.5 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

HMPX(S)-011"

HMPX(S)-013"

HMPX(S)-014"

Note: for cavity dimensions see table C010 section 1